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PARALLELISMS IN STRUCTURE BETWEEN CERTAIN GENERA OF ODONATA FROM THE OLD AND THE NEW WORLDS.

BY PHILIP P. CALVERT, PH.D.

The African genus *Pseudomacromia* Kirby has been compared by Dr. Karsch[1] with the neotropical *Macrothemis* Hagen. In the identification of the species of *Pseudomacromia* (*P. Donaldsoni* n. sp.), described in the preceding paper, I have studied the other species of this genus, as well as those of the genera *Zygonyx* Selys and *Schizonyx* Karsch, chiefly with the view of learning to what extent these three Old World groups parallel, in their structure, the New World *Macrothemis* and its allies. As a basis for this comparison I have used a recent paper,[2] in which I have shown that the five American genera *Dythemis*, *Paltothemis*, *Scapanea*, *Brechmorhoga* and *Macrothemis* form a group (of the subfamily Libellulinæ), the chief peculiarity of which is "the modification of the armature of the second and third femora in the males, and of the tarsal nails in both sexes," the details of the modification being characteristic for each genus, *Dythemis* being the least modified, *Macrothemis* the most modified of the five.

The reason for the comparison of *Schizonyx*, *Pseudomacromia* and *Zygonyx* with *Macrothemis*, etc., is that they show similar modification of the femoral armature and of the tarsal nails.

The following species are referred to these three genera respectively:

To *Schizonyx* Karsch, *luctifera* Selys (type of the genus);

To *Pseudomacromia* Kirby, *torrida* Kirby (type of the genus), *Donaldsoni* Calvert, *hova* Rambur, *speciosa* Karsch and *pretiosa* Karsch;[3]

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[1] Entomologische Nachrichten, xvii, p. 73, 1891; Berlin, Ent. Zeits., xxxviii, p 21, 1893.

[2] The Odonate Genus *Macrothemis* and its Allies. Proc. Bost. Soc. Nat. Hist., xxviii, pp. 301-332, 2 pls., July, 1898.

[3] *Speciosa* and *pretiosa*, described from male and female respectively, are perhaps one and the same species, for Mr. McLachlan writes me, under date of March 3, 1899: "I come round to the opinion that these are probably

To *Zygonyx* Selys, *ida* Selys (type of the genus) and *iris* Selys.

In order that the structure of these species may be compared most readily with that of their American analogues, the following tabular form, used on pages 303 and 304 of my *Macrothemis* paper, is also employed here : —

♂ ♀ of one species, but the spining of the legs is considerably different." A difference in the same parts of the two sexes is found in *Macrothemis*.

Ps. luxuriosa Karsch was later stated by him to be a synonym of *Zygonyx ida* Selys (Ent. Nach., xxi, p. 203). *Tyriobapta* Kirby, placed by its author (Trans. Zoöl. Soc. Lond., xii, p. 262) next to *Macrothemis*, has, I believe, nothing to do with the genera here considered.

CHARACTERS.	*S. luctifera.* ♂ ♀	*Ps. torrida.* ♂ ♀	*Ps. Donaldsoni.* ♂	*Ps. hova.* ♂	*Ps. speciosa.* ♂	*Ps. pretiosa.* ♀	*Z. ida.* ♂ ♀	*Z. iris.* ♂
Antero-inferior row of teeth or spines on								
1. The second femora.	Short spines, directed toward the knee.	....	Spines, directed toward the knee.	Teeth, directed toward the knee.	Teeth, inclined toward the knee.	Very small teeth, apparently inclined toward the knee.	Short teeth, directed toward the knee.	....
2. The third femora.	Short spines, directed toward the knee.	("Femora distinctly serrated beneath.")	Shorter, more numerous spines, directed toward the knee.	More numerous teeth, directed slightly toward the knee.	Very short, uncinate teeth, inclined toward the trochanter.	Only two nearly triangular teeth, close to the base, of no special direction.	Of about the same number (25) as on 2d fem., slightly larger, first 8–9 directed toward knee, then 1–2 not inclined, then 11 or 12 directed toward trochanter, last 1–2 not inclined (♂); in ♀ all directed toward knee, last 2–3 are longer spines.	....
3. Tooth of the tarsal nails.	Considerably shorter than tip of nail itself, acute.	Shorter than tip of nail itself.	Much shorter than tip of nail itself, acute.	Stouter, and as long as, or longer than, tip of nail itself, acute.	Stronger than the tip, but scarcely shorter.	Stronger than the tip, but scarcely shorter.	Stouter and as long as, or slightly longer than, tip of nail itself.*	Strong, as long as the tip of nail itself.*

4. Vertex at tip.	Truncated.	....	Barely concave.	Truncated or barely concave.	....	....	Truncated.	....
5. Nodal sector at its middle.	Waved.	Waved.	Waved.	Slightly waved.	Waved.	Waved.	Waved.	....
6. Number of rows of cells in the middle of the field, between the subnodal sector and the supplementary sector next below.	One.	Two.	Two.	One.	One.	One.*	One.*	....
7. Arculus, position of.	Between first and second antenodals.	As in *S. luctifera*.	As in *S. luctifera*.	As in *S. luctifera*.	....	As in *S. luctifera*.	At the second antenodal.*	....
8. Submedian cross-veins.	One.	One.*	One.	One.	One.*	One* (front wings). Two* (hind wings).	Two* (front wings). One (hind wings).	....
9. Discoidal triangle of front wings.	Free.*	Crossed.	Crossed.	Crossed.	Crossed.	Crossed.	Free.*	Crossed.
10. Discoidal triangle of hind wings.	Free.	Free.*	Free.	Free.	Crossed.*	Crossed.	Crossed.*	Crossed.
11. Internal triangle of front wings.	3-celled.*	3-celled.*	3-celled.	3-celled.	3-celled.	3-celled.	2-3 celled.*	3-celled.
12. Posttriangular rows, front wings.	Two.*	Three.	Three.	Three.	Three.	Three.	Two.	Three.
13. Posttriangular rows, hind wings.	Two.*	Three.	Two.	2-3.	....	Three.	1-2.	Three.
14. Sectors of triangle in hind wings have their origins.	At same point.	At same point.	At same point.	At same point.	At same point.	At same point.	Separated.	Separated.
15. Genital hamule of male.	Bifid.	....	Not bifid.	Slightly notched at tip.	....	....	Bifid.	....

The asterisks (*) mark characters known to be variable, as mentioned in the following remarks.

Remarks on the preceding table —Characters 14 and 15, which have no corresponding entries in the table in the *Macrothemis* paper quoted, show some differences of these species from the "Common characters of the Genera" *Dythemis*, etc., listed on p. 301, *l.c.* *In all other respects that list of Common Characters is to be understood to apply to the species here tabulated,* although occasional individual variations exist. Thus, I noted that the last antenodal on one front wing of one female *Z. ida* was continued to the median vein; Baron de Selys has a similar note for *Z. iris;* Mr. Kirby mentions the existence of one hypertrigonal (supratriangular) vein in one wing of one male *Pseudomacromia torrida.*

Schizonyx.

The data given for *S. luctifera* in the table are based on personal examination at various times of seven males, two females. 9[4] is crossed in one wing of two males, 11 is 1–2-celled in three males, 12 sometimes begins with three cells or is interrupted by three cells, 13 in some begins with three cells. For bibliography of *luctifera* see *Proc. Acad. Nat. Sci. Phila.*, 1898, p. 146. *Schizonyx* differs from *Pseudomacromia* and *Zygonyx* not only in some of the characters tabulated, but also in having a slight enlargement on the posterior margin of the eye, such as is found in the Cordulinæ, and in its pterostigma being shorter on the hind wings than on the front wings.

Pseudomacromia torrida Kirby.

The data given in the table and those which follow on variations are derived entirely from Mr. Kirby's descriptions and figure (*Trans. Zool. Soc. Lond.*, xii, p. 262, 299, 340, pl. lii, f. 7). As *Ps. Donaldsoni* so closely resembles *torrida* in other respects, it will probably be found that the few data lacking for *torrida* are as in *Donaldsoni.* As to the variations of *torrida*—8. two cross-veins in one wing out of twenty-four wings; 10. crossed in two wings out of twelve; 11. four-celled in three wings out of twelve.

Pseudomacromia hova.

Libellula hova Rambur, *Névr.*, p. 92, 1842, doubtfully referred to *Onychothemis* by Mr. Kirby (*Cat. Odon.*, p. 24, 1890), was placed with *Pseudomacromia* by Dr. Karsch (*Berl. Ent. Zeit.*, xxxiii, p. 369, 1890; xxviii, p. 21, 1893).

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[4] These numbers refer to the numbered characters of the table.

I examined Rambur's type, now in the University Museum, Oxford, England, September 3, 1896, and made some notes upon its venation, some of which are incorporated in the above table, while the others follow here:

Front wings with 10 (right), 11 (left) antenodals, the last one not continued to the median vein, 7 postnodals. Hind wings with 7 antenodals, 8 postnodals, inner (basal) side of the triangle a little nearer than the arculus with which, if produced, it would form a small angle; two or three posttriangular rows, rather irregular and not symmetrically developed on right and left wings. Total length of body 47 mm., abdomen 32, front wing 38, pterostigma 3.5.

The data given for *hova* in the table are based on the type male and on a male from Nossi-Bé, Madagascar coast, given me by Baron de Selys-Longchamps.

Pseudomacromia speciosa (♂) and **pretiosa** (♀).

The data given for characters 3, 6–13, are drawn from Dr. Karsch's and Mr. McLachlan's descriptions and figure (*Ent. Nach.*, xvii, pp. 73, 74, taf. ii, 1891, 1 ♂, 1♀ ; *Ent. Mo. Mag.* 2, ii, p. 111, 1891, 2 ♂, 1♀). For Nos. 1–3, 5 and 6 I am also indebted to a letter from Mr. McLachlan, in which he expresses his opinion, already quoted, that these two nominal species are really one.

Variations of *speciosa:* 8. Of the three males known, one has two submedian cross-veins in both hind wings (McLachlan, *l. c.*). 10. Dr. Karsch mentions that it is free on the left wing of the male he examined.

Variations of *pretiosa:* 6. Mr. McLachlan in his letter writes, "one or two asymmetrical double cellules in the posterior wings." 8. Dr. Karsch mentions two on the left front wing of his type, Mr. McLachlan three on the right hind wing of his specimen.

The species of *Pseudomacromia* fall into two groups as regards the tarsal nails; one (see the table, character No. 3) comprising *torrida* and *Donaldsoni*, the other *hova* and *speciosa* (with *pretiosa* as ♀). *Hova* differs from *speciosa* in character No. 2, and perhaps also in its superior appendages, "munis en dessous et un peu lateralement, à l'endroit de leur epaisseur, d'une pointe très-courte" (Rambur), a point easily seen in the male I possess. *Ps. Donaldsoni* lacks this "point," and its presence is not mentioned for *speciosa.* It may perhaps be questioned whether all five of these species are congeneric, but until a study is made of the male genitalia of *torrida* and of *speciosa,* it will be advisable to retain them as they here stand.

Zygonyx ida Selys.

The data for characters 1–7 are based on personal examination of a male and a female from Java, by Herr Fruhstorfer, given me at the Königliche Museum für Naturkunde at Berlin, and a female from Trong, Lower Siam, by Dr. W. L. Abbott, in the U. S. National Museum. For Nos. 8–13, the descriptions of Baron de Selys (*Ann. Soc. Ent. Belg.*, xxxv, CR., p. ccxxviii, 1891, 13 ♂, 5 ♀) and Dr. Karsch (*Berl.. Ent. Zeit.*, xxviii, p. 21, 1893, 9 ♂, 4 ♀; *Ent. Nach.*, xxi, p. 203, 1895) are also available:

Variations: 3. Distinctly shorter on the second tarsi only of the Siamese female. 6. Two double cells in one front wing of the male and of one front wing of one female, one double cell in all the wings of the other female. 7. A little nearer in three out of the twelve wings. 8. One in one front wing of one male. 9. Crossed in three females (Selys). 10. Crossed in seven males, five females, free in six males (Selys); in some free, in some asymmetrically or symmetrically crossed (Karsch). 11. The statement in the table is from de Selys, *l.c.*; I find it one-celled in one wing of one male and of one female.

Zygonyx iris Selys.

The statements in the table are all drawn from Baron de Selys' description, *l.c.*, p. ccxxxi.

Variations: 3. "Asymétriquement un peu plus-courte à l'un des tarses" (Selys).

CONCLUSIONS

Owing to the small number of individuals of these species which it was possible to examine, I have thought it undesirable to calculate the percentages of variations, as was done for *Macrothemis.*

When the exclusively American *Dythemis, Paltothemis, Brechmorhoga, Scapanea*[5] and *Macrothemis* are compared with *Schizonyx,*

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[5] I was in error when I stated by implication (Proc. Bost. Soc. Nat. Hist., xxviii, p. 303) that the nodal sector of *Scapanea* is invariably not waved. In some individuals it is waved, as Mr. McLachlan has pointed out to me by letter, but I am not able to say which of these two conditions is the predominant one, owing to inability to examine a long series of specimens.

Pseudomacromia and *Zygonyx*, genera confined to the Old World, it is evident that *in spite of the resemblance in many peculiarities, no complete parallelisms in structure exist.* Thus *Macrothemis*, the most specialized of the former group, agrees with *Zygonyx ida* in characters numbered 3, 6, 9, 12 and 13, but differs from *Z. ida* in Nos. 2, 10, 14 and 15; it agrees with *Pseudomacromia speciosa* (*pretiosa* ♀) in Nos. 2, 3, 6 and 14, but differs therefrom in Nos. 9, 10, 12 and 13; it agrees with *Ps. hova* in Nos. 3, 6, 10 and 14, but differs therefrom in Nos. 2, 9 and 12. Similar results follow a comparison of the other genera.

Dr. Karsch[6] has pointed out a further analogy between *Pseudomacromia* and *Macrothemis*: the females have a strong tendency to colored wings, the males to hyaline wings, although in the Libellulinæ, as in other insects, it is usually the reverse.

As regards climatic distribution, both the American and the Old World genera are inhabitants of the tropical and subtropical zones, the northern and the southern boundaries of the latter being formed by the annual isotherms of 20° C. The one exception to this statement appears to be a male from Chile, referred to variety *typographa* of *Macrothemis inequiunguis.*[7]

I believe that we do not yet know enough of the relationships of the Libellulinæ to enable one to form an opinion on this question: Have the peculiar forms of the tarsal nails and of the femoral armatures been independently acquired by these New World and these Old World genera, or are they inheritances from a common ancestor ? Of the physiological significance of these structures we know absolutely nothing, and we await the observations of some naturalist on the living insects to supply us with such information.

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[6] Ent. Nach., xvii, p. 73, 1891.

[7] Proc. Bost. Soc. Nat. Hist., xxviii, p. 319.